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ПУТЬ НИКОЛАЯ НИКОЛАЕВИЧА ЛУЗИНА В НАУКУ

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THE PATH OF NIKOLAI N. LUZIN INTO SCIENCE

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Abstract. The emergence of N.N. Luzin's research «Integral and a trigonometrical row» became an important event in the history of science. For the first time this work was published in 1915, and a year later it was presented to the physical and mathematical council of the Moscow University as the master thesis. In the council N.N. Luzin was awarded doctor's degree for this research at once. This event was preceded by the difficult period in the scientist's life. From the archival sources it has been found out that N.N. Luzin studied quite successfully at the university. Before the defence of the master thesis N.N. Luzin was on a scientific business trip in France and Germany twice where he communicated with famous European mathematicians. In the article new facts are provided which define the value of the Moscow professor D.F. Egorov in N.N. Luzin's fate. D.F. Egorov helped N.N. Luzin to enter the circle of scientific problems of that time, gave positive responses twice for N.N. Luzin's work «Integral and a trigonometrical row». The way which was done by N.N. Luzin in science, is instructive, and his thesis remains a model of the scientific creativity on mathematics so far.

Keywords: the history of science, the formation of the scientist (on the example of N.N. Luzin), methods of teaching mathematics, history of mathematics education.

1. Introduction

In 1915 in Moscow the unique mathematical work «Integral and a trigonometrical row» was issued, belonging to the feather of the future academician N.N. Luzin (1883–1950). This work was presented as his master thesis to the academic council of the physical and mathematical faculty of Imperial Moscow University. However during the defence of the thesis on the 27th of April, 1916 there was an extraordinary

phenomenon – the academic council decided unanimously to award N.N. Luzin the degree of the doctor of abstract mathematics, passing the intermediate degree of the master (a very rare case in the practice of universities of that time).

The emergence of this brilliant thesis was preceded by long and persistent work of the author. His formation as a scientist was rather difficult, N.N. Luzin's biography is instructive in many respects, full of tragic and happy events.

His election in the 1920th years as the member of a number of authoritative scientific communities became a sign of recognition of Luzin's scientific merits: the corresponding member (1927), the active member of the Academy of Sciences of the USSR (1929), the member of the Krakow Academy of Sciences, the honorary member of the Belgian mathematical society and Mathematical society in Calcutta. In 1928 on the VIII International Mathematical Congress in Bologna on which he made the plenary report «About the ways of development of the theory of sets», he was elected the vice-president of the Congress.

The works of his pupils and colleagues N.K. Bari, V.V. Golubev, P.I. Kuznetsov, M.A. Lavrentyev, etc. are devoted to the biography of the academician (Bary [1], Kuznetsov [2], Lavrent'ev [3]). The Moscow scientists revealed N.N. Luzin's contribution to the development of mathematics, the scientific tree of the scientist (the names of all his pupils and followers) was reconstructed.

His political persecution in the summer of 1936 which became the history under the name «Luzin's Affairs» became a heartrending experience for the academician. S.S. Demidov and S.S. Kutateladze's researches are devoted to the study of this tragic episode in the life of the scientist (Demidov [4], Kutateladze [5]).

In 1999 the remained shorthand report of a meeting of the Commission of Presidium of Academy of Sciences of the USSR was published by miracle, in 2002 in the USA there was some work which imprinted G.G. Lorentz's memoirs (1910–2006) – the witness of mathematical events in the USSR of that time (Lorentz [6]).

However in the scientific heritage and N.N. Luzin's biography there are still many white spots, poorly studied facts.

2. Materials and methods

The purpose of this work is the research of the student's and the subsequent to it period of the preparation of the master thesis in N.N. Luzin's life. The tasks were set: 1) to establish which disciplines he studied at the university; 2) what professors taught him; 3) which of those professors had the defining impact on N.N. Luzin's formation as a scientist. For the implementation of the goal we used predictive, historical and comparative, historical and system methods of knowledge. Preference was given to studying the primary sources (archival documents, and also the letters and works written by N.N. Luzin). The research consisted of three stages. At the first stage gaps in N.N. Luzin's biography were established, the underestimation of D.F. Egorov's role in the formation of the future academician was revealed. At the second stage a search of the documents allowing to restore these gaps was carried out. The documents which are stored in the funds of the Central state archive were found and studied. At the third stage comparison, generalization and systematization of the facts, ideas, research materials was carried out.

3. Discussion

As the famous poet said: «A big thing is seen at distance». Today a hundred years later after a release of the composition «Integral and a trigonometrical row», it is obvious that the time has come to track in detail and without ideological stamps that way which led Nikolay Nikolaevich to the fundamental discoveries made in his master thesis representing up to now an unsurpassed model of the scientific research of such a level.

4. Results

Nikolay Nikolaevich Luzin was born on the 27th of November (on December 9th), 1883 in the Siberian city of Tomsk in the family of the trade employee Nikolay Mitrofanovich Luzin. Nikolay Nikolaevich got a secondary education in the Tomsk gymnasium.

The known and quite an extraordinary fact in the biography of the future academician was that in the senior classes he had some difficulties while studying mathematics. Then his father invited the talented student as a tutor from the Polytechnical Institute which had been opened in Tomsk recently. The student

helped the teenager to solve many tasks from various books of elementary mathematics, and the result surpassed all expectations: Nikolay became the best on mathematics among his schoolmates quickly enough.

In the Central state archive of Moscow the school-leaving certificate of Nikolay Luzin from which it is possible to learn a number of interesting data remained:

«The school-leaving certificate is given to Nikolay Luzin, religion of the Orthodox Christian, the son of the petty bourgeois who was born on the 27th of November, 1883 in Tomsk and trained one year in the Irkutsk gymnasium and seven years in Tomsk.

It is given, firstly, on the basis of the supervision of his studying in the Tomsk gymnasium all the time, his behavior was excellent in general, the serviceability in attendance and preparation for the lessons, and also in the performance of written works was excellent, diligence was good and inquisitiveness was excellent, secondly, that he showed the following knowledge in:

The God's law – 5 (5);
Russian language, Church Slavonic language and literature – 4 (4);
Logic – 5
Latin language – 4 (4);
Greek language – 4 (4);
Mathematics – 5 (5);
Mathematical geography – 5;
Physics – 5;
History – 5 (5);
Geography – 5 (5);
French language – 3 (3)" [7].

After leaving gymnasium in 1901 N.N. Luzin moved to Moscow with parents where he entered the mathematical department of the physical and mathematical faculty of Imperial Moscow University. Nikolay didn't plan to connect his future with mathematics, he considered his entrance in the University as an intermediate step to receiving engineering education. He dreamed to enter the St. Petersburg Polytechnical Institute, but, being afraid of difficult entrance examinations (the competition in this educational institution was extremely high then), he preferred to take a two-year university course at the mathematical department on the basis of which they admitted to Polytechnical Institute without examinations.

At the university there was an unexpected metamorphosis with Nikolay's scientific and professional preferences. He was fond of mathematics so much that soon he forgot about the initial intention to become an engineer. N.V. Bugaev (1837–1903) whose lectures fascinated the young man became one of the first professors who had an impact on the formation of N. Luzin's scientific interests.

At this time N.N. Luzin listened to the lectures of brilliant professors: N.E. Zhukovsky (1847–1921) – on mechanics; E.E. Leyst (1852–1918) – on meteorology and terrestrial magnetism; I.A. Kablukov (1857–1942) – in chemistry; V.K. Tserasky (1849–1925) – on astronomy; K.A. Andreyev – on higher algebra); B.K. Mlodzeevsky (1858–1923) – on analytical geometry; L.K. Lakhtin (1863–1927) – on the differential equations; D.F. Egorov (1869–1931) – a special course, etc. At this time the theory of functions and the theory of sets began to get into the walls of the Moscow University (for example, the course read by professor B.K. Mlodzeevsky and the lectures of associate professor I.I. Zhegalkin (1869–1947)).

N.N. Luzin didn't stand aside and from the public life of the department. At the university he made friends with the student P.A. Florensky (1882–1937) who was also studying at the mathematical department one course more senior than he was [8].

In the fall of 1902 the third-year student P. Florensky (1882–1937) had a burning desire to create the students' mathematical circle at the university. At the meetings of the circle professors N.E. Zhukovsky, L.K. Lakhtin, B.K. Mlodzeevsky, D.F. Egorov, etc. spoke. The student N.N. Luzin took an active part in the work of students' circle and was elected the secretary of it [1, p. 10].

In the years of studying at the university the theory of sets got to a focus of N.N. Luzin's interest with the help of N.V. Bugaev and P. Florensky's influence – it was then a new section of mathematics created in the last third of the XIX century by the German scientist G. Kantor (1845–1918). On the basis of this theory in the 1890th years the French mathematics E. Borel (1871-1956), A. Lebesgue (1875 - 1941) and R.-L. Beram (1874–1932) constructed the theory of explosive functions – the theory of functions of valid

variable quantity. At the first International Mathematical Congress in Zurich (1897) this theory was in the center of the gathered scientists' attention. At this congress the Moscow mathematical school was represented by N.V. Bugaev who gave the brilliant report at the plenary session. Being a student, N.N. Luzin also started studying these questions.

D.F. Egorov began to take care of N.N. Luzin at the university. It happened not at once. At first sight Nikolay Luzin wasn't distinguished from his classmates but if he was carried away by any question, he tried to understand it quite deeply, he read additional literature, thought out the proofs. Once he took his examination to D.F. Egorov who paid attention to Nikolay Luzin's original answers. Professor began to invite the student to his individual consultations, set difficult tasks before him, discussed their possible decisions.

In 1905 the normal course of the university classes was broken by the revolutionary events. Being afraid of the talented student's involvement in them (there were enough reasons for concern – it is known that under Luzin's bed revolutionary students stored bombs and leaflets), his teacher D.F. Egorov organized for him a business trip to Paris where he was sent together with another pupil V.V. Golubev (1884–1954).

During these restless years Luzin endured the heavy nervous shock connected both with the revolutionary events, and with the doubt whether he was correct to choose that profession. In his letters D.F. Egorov tried to influence the unbalanced young man, convinced him to continue serious work at mathematics. In the letters he urged N.N. Luzin to attend G. Hadamard's lectures who read them «perfectly and very substantially», according to D.F. Egorov's opinion, [9]. Pavel Florensky's letters gave big spiritual help to Nikolay. As a result N.N. Luzin gradually returned to science: to the work in the Parisian libraries; to the classes in Sorbonne where he attended E. Borel and A. Poincare's lectures; and also in Collège de France where he took G. Hadamard and G. Darboux's courses.

Having come back to Russia, N.N. Luzin continued his studies at the Moscow University which he graduated from in 1906 with the diploma of the first degree (today we would say with honors). In the Central state archive of Moscow Nikolay Nikolaevich's diploma about the higher education remained which was issued to him on the 21st of August, 1907. In this document it is certified that in the fall of 1906 he passed the tests in the physical and mathematical commission and during his training he received high marks (we will notice that the mark «quite satisfactorily» was the highest in the three-point scale that existed then: unsatisfactorily, satisfactorily, quite satisfactorily).

1. N.N. Luzin's results at the course examinations:

– analytical geometry (the 1st and 2nd parts) – quite satisfactorily;
– higher algebra – quite satisfactorily;
– differential calculus – quite satisfactorily;
– differential geometry – quite satisfactorily;
– integral calculus (the 1st part) – quite satisfactorily;
– physics (the 1st and 2nd parts) – quite satisfactorily;
– mechanics – quite satisfactorily;
– chemistry – quite satisfactorily.

2. N.N. Luzin's results at the final examinations:

– integral calculus (the 2nd part) and the theory of probability – quite satisfactorily;
– mechanics (the 2nd part) – quite satisfactorily;
– astronomy – satisfactorily;
– meteorology and terrestrial magnetism – quite satisfactorily;
– the theory of functions (an additional subject) – quite satisfactorily;
– the equations with private derivatives – satisfactorily;
– composition – quite satisfactorily [7].

When graduating from the university N.N. Luzin was left to be prepared for a professorial rank.

By 1909 he had passed the master examinations and was entitled the existing then «undergraduate» together with the right of teaching at the higher school after reading two trial lectures, the one at his own choice and the second one to the destination of the faculty. Luzin read trial lectures and assumed to begin teaching at the university in the fall of 1910. However, he didn't start his work then as he was sent to a new

scientific business trip to Goettingen (Germany) and Paris (France) for the improvement of the mathematical knowledge and acquisition of research experience.

This business trip was extremely fruitful for Luzin. N.N. Luzin's arrival to Paris coincided with the beginning of work of the seminar which had just been organized by G. Hadamard in Collège de France. At first G. Hadamard himself made the review of the works which captured different areas of mathematics, and then the young began to make reports. The young Russian scientist took an active part in this seminar, and also came into close contacts with E. Pikar (1871–1956), E. Borel (1871-1956), A. Lebesgue (1875-1941), A. Denjoy (1884–1974) and other European mathematicians. He worked a lot and successfully on the master thesis and in 1912 he published some notes in the edition of Academy of Sciences of France «Comptes Rendus». These publications gained fame in Europe and Russia almost at once. In particular, one of them contained the theorem of S-property bearing his name nowadays – Luzin's theorem.

During the foreign business trip Nikolay Nikolaevich didn't lose contact with the Moscow mathematicians, he corresponded with them actively. Among his constant addressees there was D.F. Egorov who did not only read the mathematical texts sent from abroad, but also helped the pupil with advice, he himself continued the search of scientific decisions in the field of the subject connected with the generalization of the concept of integral and the origin of the concepts of the theory of functions of the valid variable quantity. In 1911 D.F. Egorov proved one fundamental theorem of the theory of functions of the valid variable quantity, bearing the name of its author nowadays.

Moreover, D.F. Egorov thought up one more way to help his pupil. We will remind that in 1897 at the Moscow mathematical society an award was founded in the name of A.U. Davidov (1823–1885) which was given for the composition on the declared subject. In 1912 D.F. Egorov being a member of the Commission on giving awards proposed to point the following subject to the competition for an award: «Decomposition of the functions in trigonometrical ranks in the connection with the latest researches in the field of expansion of the concept about the integral» [10]. Undoubtedly, formulating the subject this way, D.F. Egorov meant that N.N. Luzin could be the only indisputable applicant for receiving an award on this subject.

After the second return to Moscow in summer of 1914 N.N. Luzin started teaching at the university as an associate professor, thus continuing to work on the master thesis.

In 1915 N.N. Luzin's work «Integral and a trigonometrical row» was published. The volume of the composition made 242 pages and included six chapters. In the introduction N.N. Luzin formulated shortly the main idea of his work: «to find the most general definition of the concept of the integral so that to expand the class of trigonometrical ranks of Fourier to possible limits» [11].

In October, 1915 this work was presented to the council of physical and mathematical faculty of the Moscow University on the competition of an award in the name of A.U. Davidov. The commission on the consideration of the composition included professor K.A. Andreyev, the dean L.K. Lakhtin and professor D.F. Egorov [12, p. 83]. On November 27th, 1915 at the meeting of the physical and mathematical faculty it was decided to give N.N. Luzin an award of A.U. Davidov of 300 roubles for the marked composition [12, p. 98].

At this time N.N. Luzin presented the same work to the council of the physical and mathematical faculty as the thesis for receiving the degree of the master of abstract mathematics. The preparation of the reference was charged to D.F. Egorov again [12, p.83].

In 1916 the composition was published in the journal «Mathematical Collection». Professors D.F. Egorov and L.K. Lakhtin acted as official opponents.

In the review of the thesis prepared by D.F. Egorov on March 16th, 1916 the detailed analysis was given to the composition and in its final part the result was summed up:

«High advantages of N.N. Luzin's work don't leave any doubt in me that it would only be fair to estimate his talent of the highest academic degree. I will add to it that N.N. Luzin has other valuable works and that his name is honourably popular in the mathematical world. I will also notice that the investigated work contains so much valuable material in its real variant that it would be enough for two separate compositions, especially at further development of some author's instructions which often have the character of a simple hint.

In view of all above I would believe certainly to the answering facts of the case, having allowed N.N. Luzin to defend the present composition and to petition, in case of the satisfactory defendence before

the Council of the Imperial Moscow University about N.N. Luzin's statement in degree of the doctor of abstract mathematics» [13, p. 110].

In some other speeches exclusive advantages of work were noted, among which there were not only opening new important mathematical facts, but the indication of a set of perspective ways of further researches.

Really, this work defined the further development of the metric theory of functions in many respects, it included the statement of several unresolved problems, which were a source of inspiration for mathematicians for ten years.

The period from 1914 to 1924 is the time of blossoming of the scientist's scientific and pedagogical activity. He read a facultative course of the theory of functions of the valid variable quantity except the obligatory courses from year to year and conducted a research seminar. This special course read by him for many years and the seminar accompanying it also became the center from which the well-known Moscow school of the theory of functions grew which gave to the world a set of new names of mathematicians – Luzin's pupils. Among the pupils of the first generation of this school were elected subsequently academicians of Academy of Sciences of the USSR: P.S. Alexandrov (1896–1982), A.N. Kolmogorov (1903–1987), M.A. Lavrentyev (1900–1980), P.S. Novikov (1901–1975), and correspondent members – L.A. Lyusternik (1899-1981), A.A. Lyapunov (1911–1973), D.E. Menshov (1892–1988), L.G. Shnirelman (1905–1938).

N.N. Luzin's fate developed quite successfully. He gained the world recognition, was elected the member of a number of academies and scientific organizations. However in the 1930th in the life of the academician there were tragic events connected with the persecution of his teacher D.F. Egorov at first, and then with the persecutions on N.N. Luzin himself. The scientist was compelled to change the place of work several times. The scope of his scientific researches underwent many changes. In the early thirties, being afraid of the charges of its excessive abstractness, he was engaged in applied tasks and differential geometry.

5. Conclusion

N.N. Luzin died on February 28th, 1950. Soon after his death the Academy of Sciences of the USSR adopted the resolution on the edition of his works. In 1953-1959 there were collected the academician's works in three volumes which included the composition «Integral and a trigonometrical row». In 1951 this work was published with comments edited by N.K. Bari and D.E. Menshov. In the same edition the book was republished in 2009 [14].

Thus, the thesis «Integral and a trigonometrical row» was published five times: during N.N. Luzin's lifetime (1915 and 1916) twice and three times after his death (1951, 1953 and 2009). Such popularity of the composition wasn't casual. For many years this work was a source of ideas for researchers from different countries working in the field of the theory of functions. N.N. Luzin's success was preceded by the fundamental mathematical education which he got at the Moscow University, professor D.F. Egorov's constant help, scientific teaching in Europe. Today N.N. Luzin's way to the academic science is very instructive too.

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